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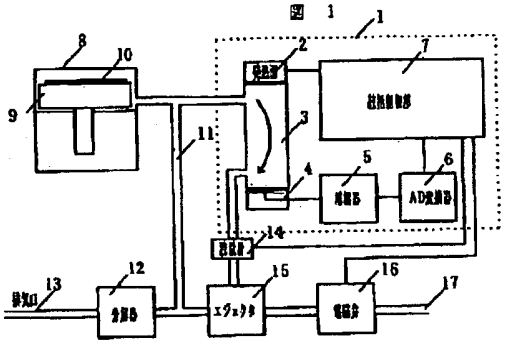
(54)【発明の名称】　半導体製造装置の加工終点検知器

(57)【要約】
【課題】半導体製造装置のアッシング処理の終点検知器で検出セルの汚れを軽減し、終点検出を確実に行う方式を提供する。
【解決手段】ウェハ１０のアッシング処理を行う処理室８と、赤外線の発生器２及び受光器４と、反応ガスを発生器２と受光器４間に導く経路を形成する検出セル３と、反応ガスを検出セル３側又は排気側に切替える切替弁１６と、受光器２の出力信号の増幅器５と、増幅器５の出力をディジタル値に変換するＡＤ変換器６と、手段を制御する統括制御部７からなり、検出セル３に反応ガスを導入するため、処理室８と排気口１３間にオゾン分解器１２を設けた排気経路１１と、処理室８と排気口１３間に検出セル３とオゾン分解器１８を直列に接続した排気経路１１とを切替弁１６とした。

図１



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【特許請求の範囲】

【請求項１】半導体製造工程で、レジストを除去するアッシング処理の終点を検知する手段として、ウェハのアッシング処理を行う処理室と、赤外線発生及び受光器と、アッシング処理の反応ガスを赤外線発生器と前記受光器間に導く経路を形成する検出セルと、反応ガスを検出セル側又は排気側に切替える切替弁と、前記受光器の出力信号の増幅器と、前記増幅器の出力をディジタル値に変換するＡＤ変換器と、前記手段を制御する統括制御部で構成し、前記ウェハを前記処理室に搬入時は、前記切替弁を検出セル側に切替え、前記ウェハの搬入後一定時間経過した時の前記ＡＤ変換器の出力値を基準レベルとした後、前記切替弁を排気側に切替え一定時間経過後、再度、前記切替弁を前記検出セル側に切替え、一定時間経過以降の前記ＡＤ変換器の出力値が前記基準レベルよりも数％減少した時に、アッシング処理の終点を判定することを特徴とする半導体製造装置の加工終点検知器。

【請求項２】請求項１に記載した前記検出セルに、アッシング処理の反応ガスを導入する手段として、前記処理室と排気口間に第１のオゾン分解器を設けた第１の排気経路と、前記処理室と前記排気口間に前記検出セルと第２のオゾン分解器を直列に接続した第２の排気経路とを並列に接続した構成とした半導体製造装置の加工終点検知器。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、主に半導体製造過程でレジスト除去等に用いる半導体製造装置でアッシング処理の終点検知に関する。

【０００２】

【従来の技術】半導体製造過程でレジストを除去するアッシング処理時間は、レジストの種類や塗布の厚さ等により様々である。多量少品種の量産工程ではレジストの種類や塗布の厚さはほぼ一様であるためアッシング処理時間は一定であるが、少量多品種の半導体製造工程では、多品種であるためそれぞれレジストの種類や塗布の厚さに応じてアッシング処理時間を設定する必要がある。これら少量多品種の半導体製造工程で効率よくレジスト除去を行うために、レジストのアッシング状態を自動的に監視し、それぞれの状況に応じてアッシング処理時間決定する終点検知器が有効である。

【０００３】終点検知の一例としてはアッシング処理で生じる反応ガス（オゾンガス及び炭酸ガス等の成分を含む）を一部検出セル内に導き、赤外線の透過量で濃度の変動を監視する方式があり、アッシング処理開始後一定時間経過したのち、この濃度変化が、予め設定したしきい値を通過したときをレジスト除去の終点としているものがある。

【０００４】本方式では、検出セル内に反応ガスを導いているため、長期使用中に検出セル内が汚れていく恐れがある。この結果、検出セル内に反応ガスがない場合でも、検出窓の汚れで赤外線の透過量が減少することで、あたかも炭酸ガスが有るかのように赤外線受光器の出力値が減少し、アッシング処理で生じる炭酸ガスの濃度を予め設定したしきい値と比較する方式では、検出レベルの変動を正確に検知出来なくなる可能性があるため、予め設定したしきい値を再度調整する必要が生じる。

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【０００５】

【発明が解決しようとする課題】アッシング処理の初期には、ウェハから除去された比較的多量の反応ガス（レジスト成分中の種々のガス）が処理室内に拡散し、排気ダクト及びオゾン分解器を介して排気口から排出される。

【０００６】従って、赤外線発生器と受光器間に導く流路を形成する検出セル内に反応ガスを吸引する方式では、常時長期に亘ってアッシング処理の反応ガスを検出セル内に吸引すると、検出窓の汚れにより受光器の信号レベルが低下し、前述のように、反応ガス中の炭酸ガス濃度を正確に検知出来なくなる可能性がある。

【０００７】本発明の目的は、検出セルの汚れ度合いを極力軽減すると共に、検出セルの汚れに影響されることなく反応ガス中の炭酸ガス濃度の測定及び規準値の設定ができ、比較的長期間に亘りアッシング処理時間の検知を可能とした半導体製造装置の加工終点検知器を提供することにある。

【０００８】

【課題を解決するための手段】上記課題は、ウェハのアッシング処理を行う処理室と、赤外線発生器及び受光器と、アッシング処理の反応ガスを赤外線発生器と受光器間に導く流路を形成する検出セルと、反応ガスを検出セル側又は排気側に切替える切替弁と、赤外線受光器の出力信号の増幅器と、増幅器の出力をディジタル値に変換するＡＤ変換器と、前記手段を制御する統括制御部で構成すると共に、前記検出セルに、アッシング処理の反応ガスを導入する手段として、処理室と排気口間に第１のオゾン分解器を設けた第１の排気経路と、処理室と排気口間に前記検出セルと第２のオゾン分解器を直列に接続した第２の排気経路とを並列に接続した構成とする。

【０００９】

【発明の実施の形態】図１は本発明の一実施例を示す終点検知器を備えたアッシング処理装置要部のブロック図である。図１で、１は終点検知器を示し、赤外線発光器２と反応ガスの経路を形成する検出セル３及び赤外線受光器４で反応ガス中の炭酸ガス濃度検知部を構成する。５は赤外線受光器４の微小出力信号をＡＤ変換可能な信号レベルまで増幅する増幅器を示す。６はＡＤ変換器、７はＡＤ変換器６、後述の流量計１４、電磁弁１６の制御及びアッシング装置本体間との通信を行う統括制御部である。

【００１０】なお、終点検知器の動作状態，炭酸ガスの濃度レベル等を表示する表示部や、終点を検知した際に装置へ処理終了信号や終点検知器の動作状況を出力する出力部及び終点検知条件等の設定を行う設定部等は割愛した。

【００１１】８はウェハのレジストを除去する処理室、９はステージ、１０はウェハ、１１は処理室８の排気ダクト、１２は処理室から排気された反応ガスの分解器、１３は分解器１２で無害化されたガスの排気口を示す。

【００１２】また、流量計１４，エジェクタ１５及び電磁弁１６は、検出セル３に処理室８の反応ガスの一部をサンプリングするために設けたもので、圧搾空気１７をエジェクタ１５加えることで、検出セル３の流量計１４が接続された配管を負圧にし、検出セルに反応ガスの一部を引き込むためにある。なお、流量計１４は検出セルに反応ガスを流す流量調整とガスが流れているか否かの検知を行うために設けている。

【００１３】図２は本発明の第二の実施例を示す。図１と比べると、特に検出セル３に反応ガスを導入する手段が異なっており、図１では圧搾空気１７とエジェクタ１５を用いて、検出セル３に反応ガスを吸引していたが、図２では空気抵抗が異なる２種類の分解器を用い、第二の分解器１８の空気抵抗を第一の分解器１２のものより小さくすることで、検出セルの入口と出口に圧力差をつけることができ、検出セル３に反応ガスを流す点が異なっている。

【００１４】図３は処理室８にウェハ１０を搬入してから処理が終了するまでの、炭酸ガス濃度変化を示すと共に、検出セルに反応ガスを流すか否かの切替えを行う電磁弁１６の動作波形の一例を示している。

【００１５】図中２０，２１，２２で示す波形は、アッシング処理（レジスト除去）中の炭酸ガス濃度を示し、２３は電磁弁１６の動作を示す。図中「サンプリング」で記載した期間が電磁弁１６を作動させている時間を表す。また、２４は処理室にオゾンを流している時間（処理時間）を表している。

【００１６】図４は本発明の半導体製造装置の終点検知器の動作を説明するフローチャートであり、半導体製造装置の装置本体に関する動作は簡便に説明し、終点検知の概要を記載した図である。

【００１７】なお、装置本体の基本動作は、装置の処理開始スイッチが押されると、カートリッジから処理するウェハを取り出し、処理室に搬送してウェハのアッシング処理（レジスト除去）を行うものとする。

【００１８】また、処理時間の決定は、タイマ処理と終点検知の方法が有る。タイマ処理では、処理室にウェハを搬送後処理時間をセットして一定時間経過すると、処理室からウェハを取り出しカートリッジにウェハを戻す作業を行い、２枚目以降はこの動作の繰り返しで、カートリッジ内に処理するウェハがなくなれば、処理を終了する。

【００１９】終点検知処理とはウェハ上のレジストが除去されたことを検知したとき、タイマ処理でタイムアップしたと同様な動作を行うものである。

【００２０】以下、図１のシステム構成図、図３の動作波形図及び図４に示すフローチャートに従って本発明（終点検知処理動作）についての動作説明を行う。

【００２１】図４において、ステップ（ａ）に示すように、アッシング処理を開始すると、図１の統括制御部７は電磁弁１６を検出セル３側に切替え（ｂ）、処理室８からの反応ガスをサンプリング出来る状態にする。図１では処理室８からの排気ガスは検出セル３，流量計１４及びエジェクタ１５を介して分解器１２への経路で流れる。その後、処理室にウェハが搬入された（ｃ）あと、一定時間（ｔ１：図３に記載）経過すると（ｄ）、その時の処理室内の炭酸ガス濃度（図３の２０で示したレベル）をメモリ１に記憶し（ｅ）終点検出判定の基準値(Ref１）とする。このように終点検出判定の基準値(Ref１）の設定を、ウェハを処理室で処理する直前に行うため、検出セルの汚れやセンサ系の経時変化等の影響を受けにくい。

【００２２】なお、電磁弁１６を検出セル３側に切替えた時、統括制御部７は流量計１４では反応ガスが流れているか否かの検知を行い、流れていなければ装置本体に流量エラーを報告する。

【００２３】次に、統括制御部７は電磁弁１６を分解器１２側に切替え（ｆ）、処理室８から直接分解器１２に排気ガスを導き、アッシング処理開始直後の排気ガスが検出セル３に流れないようにする。

【００２４】しばらくこの状態（検出セル３には反応ガスを流さない）で、処理室８にはオゾンが供給されアッシング処理が行われる。

【００２５】電磁弁１６が切替えられて一定時間（ｔ２：図３にｔ２で示す）経過すると（ｈ）、統括制御部７は再度電磁弁１６を検出セル３側に切替え（ｉ）、反応ガス中の炭酸ガス濃度を連続して計測する（ｊ）。この期間が図３の２３で示したサンプリング期間で、終点を検出するまで連続的に炭酸ガス濃度をサンプリングする。

【００２６】図４においてステップ（ｊ）で計測したＡＤ変換器の出力を汚れ検出設定値Ｄと比較し、ＡＤ変換器の出力が汚れ検出設定値Ｄよりも大きければ（（ｋ）でＮＯ）、また、図４のステップ（ｌ）で、ＡＤ変換器の出力を基準値に係数を乗じた値(Ｋ・ref１）と比較し、大きければ（（ｌ）でＮＯ）、（ｊ）に戻り、ＡＤ変換器の出力を再度読み取り、ステップ（ｊ），（ｋ），（ｌ）を繰り返す。

【００２７】上記（ｊ），（ｋ），（ｌ）を繰り返しているとき、ＡＤ変換器の出力が基準値に係数を乗じた値（Ｋ・ref１）よりも小さくなれば（前記（ｌ）でＹＥ

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S)、レジスト除去の終点を検知したこととし、装置制御部に終点検知信号を出力することで終点検知動作は終了する。図3の２２で示したレベルが基準値に係数を乗じた値(K・ref１)を表している。なお、係数は０＜K≦１の値をとるものである。

【００２８】この後、オゾンガスの供給は停止され（ｍ）、処理室内のウェハはカセットに搬出されて（ｎ）アッシング処理は終了するが、ステップ（ｏ）でカセット内のウェハをすべて処理したか判定し、未処理のウェハが有る場合は、ステップ(b)に戻って、次のウェハを処理する動作を行い、カートリッジのウェハが無くなるまでステップ（ｂ）から（ｏ）までを繰り返し動作する。

【００２９】また、前記ステップ（ｊ），（ｋ），（ｌ）を繰り返しているとき、（ｋ）でＡＤ変換器の出力Ｍが、汚れ検出設定値Ｄよりも小さくなれば、反応ガス（炭酸ガスを含む）を導いているセルの汚れと判断して、セルを点検するように表示（ｐ）を行うことで、比較的汚れにくいシステムであるが徐々に汚れが蓄積してきた場合に備えた対策を講じている。

【００３０】

【発明の効果】本発明によれば、処理室と排気口までの経路に、反応ガスを第１の排気経路と第２の排気経路とに切替える切替弁を設け、検出セル側又は排気側に切替弁を切替え反応ガスの流れを任意に変更することで、アッシング処理の初期にウェハから除去された比較的多量のレジスト成分のガスを検出セルに流さずに、排気ダクト及びオゾン分解器を介して排気口から排出することで、検出セルの汚れを軽減することができる。

【００３１】また、反応ガスの測定において、処理室にウェハを搬入後一定時間ｔ１経過した時のＡＤ変換器出力値を基準レベルRef１ とした後、一定時間ｔ２経過後のＡＤ変換器出力値が基準レベルRef１ よりも数％減少した時刻を以ってアッシング処理の終点とすることで、処理の終点を判定するレベルを固定しない為に、長期間の使用で生じる検出セルの汚れによる信号レベルの変動に対しても、汚れの影響を軽減することが出来る。

【００３２】この結果、例えば経時変化によりガスの流路を形成するセルが汚れ、増幅器の出力レベルが長期的に変動しても、炭酸ガス濃度をウェハの処理中の間だけに限って比較をしているため、増幅器の出力レベルが長期的に変動しても、ウェハの処理中の間だけ、炭酸ガス濃度を安定して検知できれば、性能上問題が無くなるため、誤動作が起こりにくい半導体製造装置の加工終点検知器を提供することが出来る。

【図面の簡単な説明】

【図１】本発明の一実施例を示す終点検知器を備えたシステムのブロック図。

【図２】本発明の他の実施例の終点検知器を備えたシステムのブロック図。

【図３】本発明の一実施例の動作説明図。

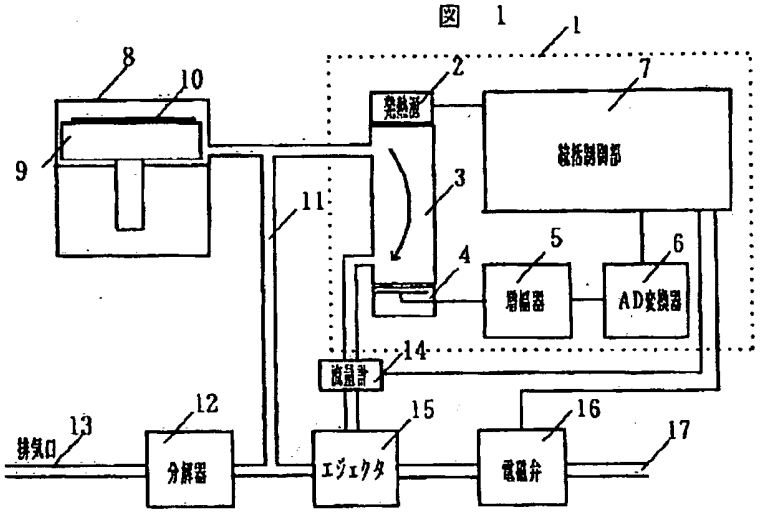
【図４】本発明の一実施例の加工終点検知器の動作フローを示すフローチャート。

【符号の説明】

１…終点検知器、２…赤外線発光器、３…検出セル、４…赤外線受光器、５…増幅回路、６…ＡＤ変換器、７…統括制御部、８…処理室、９…ステージ、１０…ウェハ、１１…排気ダクト、１２…オゾン分解器、１３…排気口、１４…流量計、１５…エジェクタ、１６…電磁弁、１７…圧搾空気。

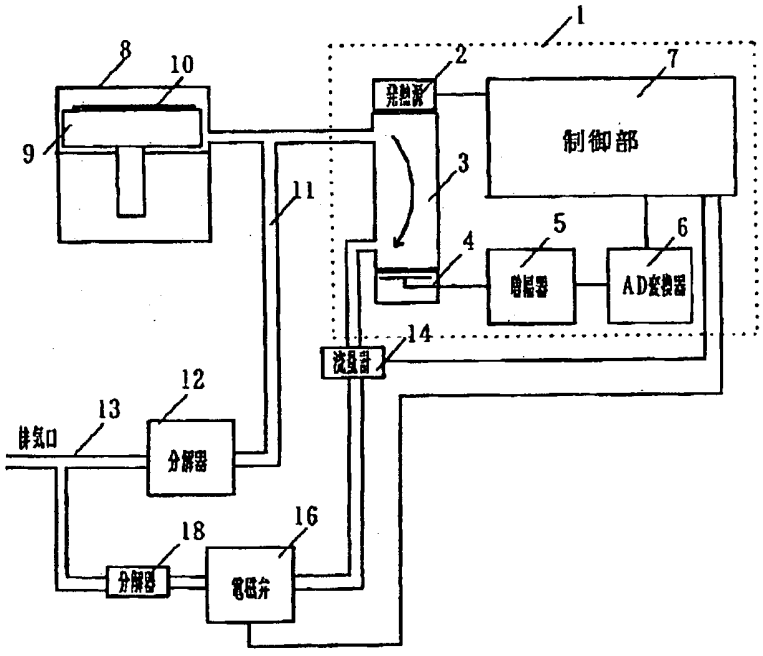
【図1】

図　1


1
2
発熱部
7
制御部
8
10
9
3
11
4
5
増幅器
6
AD変換器
14
流量計
12
13
排気口
分解器
15
エジェクタ
16
電磁弁
17

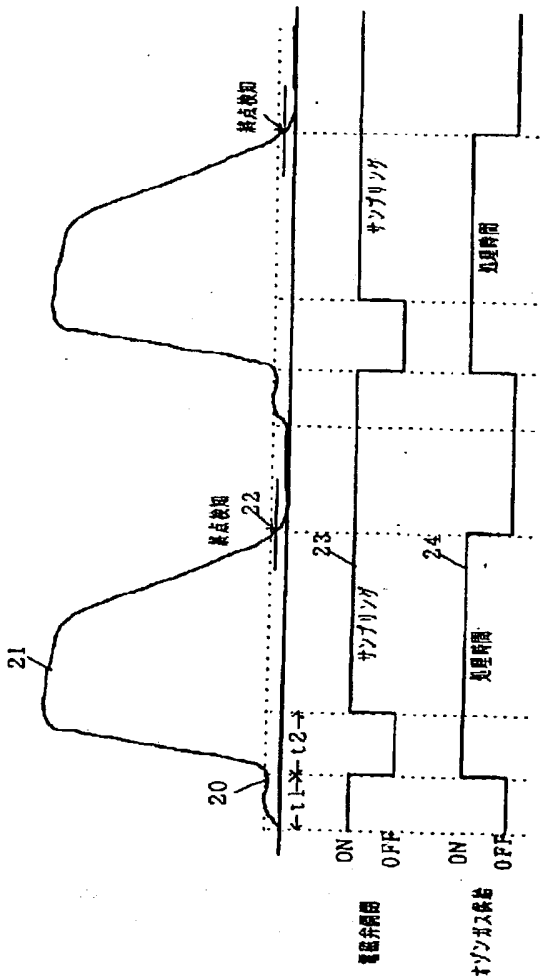
【図2】

図　2


1
2
発熱部
7
制御部
8
10
9
3
11
4
5
増幅器
6
AD変換器
14
流量計
12
13
排気口
分解器
18
分解器
16
電磁弁

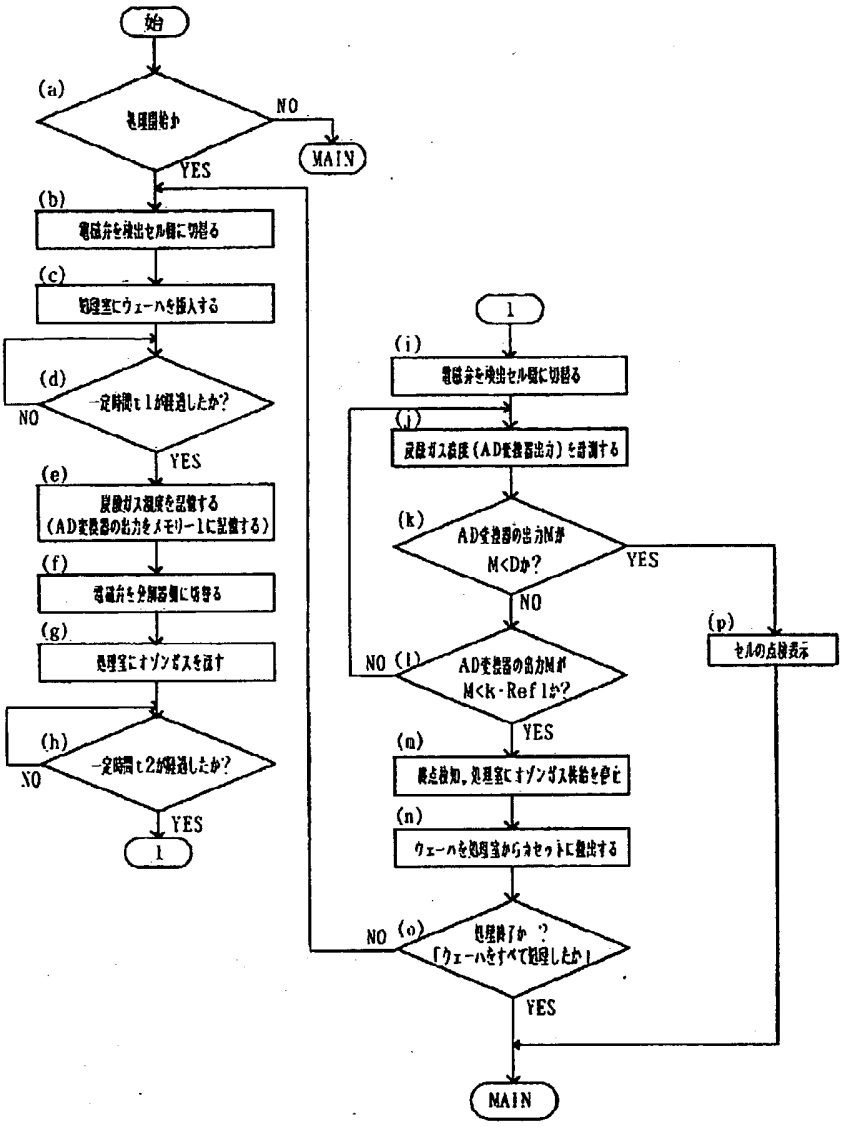
【図3】

図3


終点検知
サンプリング
処理時間
終点検知
22
23
24
サンプリング
処理時間
21
20
←t1→←t2→
ON
OFF
ON
OFF
電磁弁開閉
ナンシガス供給

【図4】

図 4


始
(a)
処理開始か
NO
MAIN
YES
(b)
電磁弁を検出セル側に切替る
(c)
処理室にウェーハを投入する
(d)
一定時間t1が経過したか?
NO
YES
(e)
炭酸ガス濃度を記憶する
(AD変換器の出力をメモリー1に記憶する)
(f)
電磁弁を空調器側に切替る
(g)
処理室にオゾンガスを流す
(h)
一定時間t2が経過したか?
NO
YES
1
1
(i)
電磁弁を検出セル側に切替る
(j)
炭酸ガス濃度(AD変換器出力)を計測する
(k)
AD変換器の出力Mが
M<Dか?
YES
NO
(l)
AD変換器の出力Mが
M<k-Ref1か?
NO
YES
(m)
終点検知、処理室にオゾンガス供給を停止
(n)
ウェーハを処理室からオセットに搬出する
(o)
処理終了か ?
「ウェーハをすべて処理したか」
NO
YES
(p)
セルの点検表示
MAIN

DERWENT-ACC-NO: 1997-463450
DERWENT-WEEK: 199743

TITLE: End point detector for semiconductor device manufacture - judges end
point when output value of analog to digital converter after fixed time progress from switching of selector valve from exhaust gas to detection cell
side, is lower than reference level

PATENT-ASSIGNEE: HITACHI LTD[HITA]

PRIORITY-DATA: 1996JP-0016397 (February 1, 1996)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
JP 09213682 A	August 15, 1997	N/A	007	H01L 021/3065

APPLICATION-DATA:

PUB-NO	APPL-DESCRIPTOR	APPL-NO	APPL-DATE
JP 09213682A	N/A	1996JP-0016397	February 1, 1996

INT-CL (IPC): G03F007/42; H01L021/027 ; H01L021/3065

ABSTRACTED-PUB-NO: JP 09213682A
BASIC-ABSTRACT: The detector (1) includes a detection cell (3) which forms a
path for drawing out the reaction gas between an IR generator (2) and an IR

observation unit (4). A selector valve (16) performs switching of reaction gas
to the detection cell/exhaust side. An amplifier (5) amplifies the output of
the IR observation part and an A/D converter (6) converts the amplifier output
into a digital value. A controller (7) shifts the wafer to a processing chamber and the selector valve is switched to the detection cell side. The
output of the A/D converter after fixed time progress, is taken as the reference level. Then, the selector valve is changed to the exhaust gas side
and again changed to the direction cell side after a fixed time progress. When
the output value of the A/D converter after fixed time progress is lower than
the reference level, the end point of the ashing process is judged.

ADVANTAGE - The use of the detector avoids stain of detection cell; and
prevents malfunctioning.

CHOSEN-DRAWING: Dwg.1/4

TITLE-TERMS:
END POINT DETECT SEMICONDUCTOR DEVICE
MANUFACTURE JUDGEMENT END POINT OUTPUT
VALUE ANALOGUE DIGITAL CONVERTER AFTER FIX TIME
PROGRESS SWITCH SELECT VALVE
EXHAUST GAS DETECT CELL SIDE LOWER REFERENCE LEVEL

DERWENT-CLASS: L03 P84 U11

CPI-CODES: L04-C18;

EPI-CODES: U11-C04A1D; U11-F01B1;

SECONDARY-ACC-NO:

CPI Secondary Accession Numbers: C1997-147685
Non-CPI Secondary Accession Numbers: N1997-386154

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 09-213682
(43)Date of publication of application : 15.08.1997

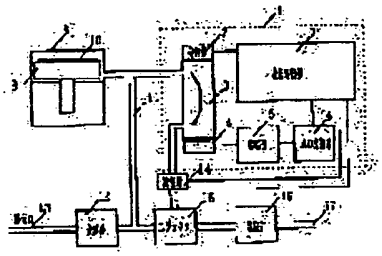
(51)Int.Cl. H01L 21/3065
G03F 7/42
H01L 21/027

(21)Application number : 08-016397
(22)Date of filing : 01.02.1996

(71)Applicant : HITACHI LTD
(72)Inventor : KAKO MASAO
FUJITO TOSHIAKI

(54) PROCESSING END POINT DETECTOR OF SEMICONDUCTOR MANUFACTURING APPARATUS

(57)Abstract:
PROBLEM TO BE SOLVED: To reduce contamination of a detection cell by a method wherein a change-over valve, which changes over reaction gas to first and second exhaust paths, is provided on a path between a treating chamber and an exhaust vent, the change-over valve is changed over to the detection cell side or an exhaust side and the flow of the reaction gas is arbitrarily changed.
SOLUTION: When an ashing treatment is started, a solenoid valve 16 is changed over to the side of a detection cell 3 by a general control part 7. Reaction gas from a treating chamber 8 is put in a state that it can be sampled. Exhaust gas from the chamber 8 is made to flow through a path to a decomposer 12 via the cell 3, a flowmeter 14 and an ejector 15. After a wafer is carried in the chamber 8, when a fixed time elapse, the value of the concentration of carbon dioxide gas in the chamber 8 at the time is stored in a memory 1 and the value of the concentration is used as the reference value of a decision for detecting the end point of the ashing treatment. Thereby, the effect of contamination of the cell 3, a change of a sensor system with time or the like is made to hardly exert on the detector.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram of the system equipped with the terminal point detector in which one example of this invention is shown.
[Drawing 2] The block diagram of the system equipped with the terminal point detector of other examples of this invention.
[Drawing 3] Explanatory drawing of one example of this invention of operation.
[Drawing 4] The flow chart which shows the flow of the processing terminal point detector of one example of this invention of operation.
[Description of Notations]
1 -- terminal point detector, a 2 -- infrared photogenic organ, and 3 -- a detector cell, a 4 -- infrared electric eye, 5 -- amplifying circuit, and 6 -- an A-D converter, 7 -- generalization control section, 8 -- processing room, and 9 -- a stage, 10 -- wafer, 11 -- jet pipe, and 12 -- an ozonolysis machine, 13 -- exhaust ports, 14 -- flowmeter, and 15 -- an ejector, 16 -- solenoid valve, and 17 -- compressed air

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[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to terminal point detection of ashing processing with the semiconductor fabrication machines and equipment mainly used for resist removal etc. in semiconductor manufacture process.

[0002]
[Description of the Prior Art] The ashing processing time which removes a resist in semiconductor manufacture process is various by the kind of resist, the thickness of an application, etc. the mass-production process of a large quantity few form -- the kind of resist, and the thickness of an application -- about -- although the ashing processing time is fixed since it is Mr. one, since it is many forms, by the semiconductor manufacturing process of small quantity many forms, it is necessary to set up the ashing processing time according to the kind of resist, or the thickness of an application, respectively In order to perform resist removal efficiently by the semiconductor manufacturing process of these small quantity many forms, the terminal point detector which supervises the ashing state of a resist automatically and makes an ashing processing-time decision according to each situation is effective.
[0003] A part of reactant gas (components, such as ozone gas and carbon dioxide gas, are included) produced in ashing processing as an example of terminal point detection is drawn in a detector cell, there is a method which supervises change of concentration in the amount of transparency of infrared radiation, and after carrying out after [an ashing processing start] fixed time progress, some which make the time of this concentration change passing the threshold set up beforehand the terminal point of resist removal are.
[0004] By this method, since reactant gas is drawn in the detector cell, a possibility that the inside of a detector cell may become dirty is during long-term use. Consequently, it will be necessary to adjust again the threshold beforehand set up since it may have become impossible to detect change of a disregard level correctly by the method in comparison with the threshold which set up beforehand the concentration of the carbon dioxide gas which the output value of an infrared electric eye decreases as if there was carbon dioxide gas because the amount of transparency of infrared radiation decreases with the dirt of a detection aperture even when there is no reactant gas into a detector cell, and is produced in ashing processing.
[0005]
[Problem(s) to be Solved by the Invention] In early stages of ashing processing, comparatively a lot of reactant gas (various gas in a resist component) removed from the wafer is spread in the processing interior of a room, and is discharged from an exhaust port through a jet pipe and an ozonolysis machine.
[0006] If it always continues at a long period of time and the reactant gas of ashing processing is attracted in a detector cell, it may become impossible therefore, for the signal level of an electric eye to fall with the dirt of a detection aperture, and to detect correctly the carbon-dioxide-gas concentration in reactant gas as mentioned above by the method which attracts reactant gas in the detector cell which forms the passage drawn between an infrared generator and an electric eye.
[0007] The purpose of this invention is to offer the processing terminal point detector of the semiconductor fabrication machines and equipment which measurement of the carbon-dioxide-gas concentration in reactant gas and a setup of a standard value were completed without being influenced by the dirt of a detector cell, continued comparatively at the long period of time, and enabled detection of the ashing processing time while mitigating the dirt degree of a detector cell as much as possible.
[0008]
[Means for Solving the Problem] The processing room where the above-mentioned technical problem performs ashing processing of a wafer, and an infrared generator and an electric eye, The detector cell which forms the passage which draws the reactant gas of ashing processing between an infrared generator and an electric eye, While constituting from the selector valve which changes reactant gas to a detector cell side or an exhaust side, amplifier of the output signal of an infrared electric eye, an A-D converter which changes the output of amplifier into digital value, and a generalization control section which controls the aforementioned means It considers as the composition which connected in parallel a processing room, the 1st exhaust air path which formed the 1st ozonolysis machine between exhaust ports, and the 2nd exhaust air path which connected the 2nd ozonolysis machine with the aforementioned detector cell in series between the processing room and the exhaust port as a means to introduce the reactant gas of ashing processing into the aforementioned detector cell.
[0009]

[Embodiments of the Invention] Drawing 1 is the block diagram of the ashing processor important section equipped with the terminal point detector in which one example of this invention is shown. By drawing 1 , 1 shows a terminal point detector, and the carbon-dioxide-gas concentration detection section in reactant gas consists of the detector cells 3 and the infrared electric eyes 4 which form the path of the infrared photogenic organ 2 and reactant gas. 5 shows the amplifier which amplifies the minute output signal of the infrared electric eye 4 to the signal level in which an AD translation is possible. It is the generalization control section to which 6 performs an A-D converter and 7 performs control of A-D converter 6, the below-mentioned flowmeter 14, and a solenoid valve 16, and communication of a between [the main parts of an ashing device].

[0010] In addition, the setting section which sets up the display which displays the operating state of a terminal point detector, the concentration level of carbon dioxide gas, etc., the output section, terminal point detection conditions which output the situation of a processing terminate signal or a terminal point detector of operation to equipment when a terminal point is detected, etc. omitted.

[0011] The resolver of the reactant gas by which a stage and 10 were exhausted for the processing room where 8 removes the resist of a wafer, and 9, and the jet pipe of the processing room 8 and 12 were exhausted for a wafer and 11 from the processing room, and 13 show the exhaust port of the gas which turned harmless by the resolver 12.

[0012] Moreover, it is what was prepared in order to sample a part of reactant gas of the processing room 8 to a detector cell 3, a flowmeter 14, an ejector 15, and a solenoid valve 16 make negative pressure piping to which it is adding ejector 15 and the flowmeter 14 of a detector cell 3 was connected in the compressed air 17, and there are in order to draw a part of reactant gas in a detector cell. In addition, the flowmeter 14 is formed in order to detect whether the flow control which passes reactant gas to a detector cell, and gas are flowing.

[0013] Drawing 2 shows the second example of this invention. Although meanses to introduce reactant gas especially into the detector cell 3 compared with drawing 1 differ and reactant gas was attracted to the detector cell 3 using the compressed air 17 and the ejector 15 in drawing 1 , in drawing 2 , using two kinds of resolvers from which air resistance differs, it can distinguish between the entrance and outlet of a detector cell by making the air resistance of the second resolver 18 smaller than the thing of the first resolver 12, and differs in that reactant gas is passed to a detector cell 3.

[0014] Drawing 3 shows an example of the wave of a solenoid valve 16 of operation which changes whether reactant gas is passed to a detector cell while showing carbon-dioxide-gas concentration change after carrying in a wafer 10 to the processing room 8 until processing is completed.

[0015] The wave shown all over [20, 21, and 22] drawing shows the carbon-dioxide-gas concentration under ashing processing (resist removal), and 23 shows operation of a solenoid valve 16. The period indicated by "sampling" among drawing expresses the time which is operating the solenoid valve 16. Moreover, 24 expresses the time (processing time) which is passing ozone in the processing room.

[0016] Drawing 4 is a flow chart explaining operation of the terminal point detector of the semiconductor fabrication machines and equipment of this invention, and operation about the main part of equipment of semiconductor fabrication machines and equipment is drawing which explained simple and indicated the outline of terminal point detection.

[0017] In addition, if the processing start switch of equipment is pushed, basic operation of the main part of equipment shall take out the wafer processed from a cartridge, shall convey it in a processing room, and shall perform ashing processing (resist removal) of a wafer.

[0018] Moreover, the determination of the processing time has the method of timer processing and terminal point detection. In timer processing, if conveyance after-treatment time is set to a processing room and fixed time progress of the wafer is carried out at it, after the 2nd sheet, the work which takes out a wafer from a processing room and returns a wafer to a cartridge is done, and it is the repeat of this operation, and if the wafer processed in a cartridge is lost, processing will be ended.

[0019] Same operation is performed with having passed the deadline of terminal point detection processing by timer processing, when it detected that the resist on a wafer was removed.

[0020] Hereafter, according to the flow chart shown in the system configuration view of drawing 1 , the wave form chart of drawing 3 of operation, and drawing 4 , explanation of operation about this invention (terminal point detection processing operation) is given.

[0021] In drawing 4 , if ashing processing is started as shown in a step (a), the generalization control section 7 of drawing 1 will be changed into the state where a solenoid valve 16 is changed to a detector cell 3 side, and the reactant gas from (b) and the processing room 8 can be sampled. In drawing 1 , the exhaust gas from the processing room 8 flows in the path to a resolver 12 through a detector cell 3, a flowmeter 14, and an ejector 15. Then, after (c) by which the wafer was carried in to the processing room, if fixed time (t1 : drawing 3 publication) progress is carried out, (d) and the carbon-dioxide-gas concentration of the processing interior of a room at that time (level shown by 20 of drawing 3) will be memorized in memory 1, and it will consider as the reference value (Ref1) of (e) terminal point detection judging. Thus, just before processing a wafer at a processing room, in order to perform a setup of the reference value (Ref1) of a terminal point detection judging, it is hard to be influenced of the dirt of a detector cell, aging of a sensor system, etc.

[0022] In addition, when a solenoid valve 16 is changed to a detector cell 3 side, with a flowmeter 14, the generalization control section 7 detects whether reactant gas is flowing, and if it is not flowing, it reports a flow rate error to the main part of equipment.

[0023] Next, the generalization control section 7 changes a solenoid valve 16 to a resolver 12 side, and leads exhaust gas to

the direct resolver 12 from (f) and the processing room 8, and it is made for the exhaust gas immediately after an ashing processing start not to flow to a detector cell 3.
[0024] For a while, in this state (reactant gas is not passed to a detector cell 3), ozone is supplied to the processing room 8 and ashing processing is performed.
[0025] (j) which (h) and the generalization control section 7 will change a solenoid valve 16 to a detector cell 3 side again, and will measure the carbon-dioxide-gas concentration in (i) and reactant gas continuously if a solenoid valve 16 is changed and carries out fixed time (t2: -- t2 shows to drawing 3) progress Carbon-dioxide-gas concentration is continuously sampled until this period detects a terminal point in the sampling period shown by 23 of drawing 3 .
[0026] If larger than the detection set point D (it is NO at (k)), the output of the A-D converter measured at the step (j) in drawing 4 by becoming dirty and the output of an A-D converter becoming dirty as compared with the detection set point D at moreover, the step (l) of drawing 4 The output of an A-D converter will be returned to (j), if large as compared with the value (K-refl) which multiplied the reference value by the coefficient (it is NO at (l)), the output of an A-D converter is read again, and a step (j), (k), and (l) are repeated.
[0027] If the output of an A-D converter becomes smaller than the value (K-refl) which multiplied the reference value by the coefficient when having repeated the above (j), (k), and (l) (it is YES by the above (l)), it will suppose that the terminal point of resist removal was detected, and terminal point detection operation will be ended with outputting a terminal point detection signal to the device control section. The level shown by 22 of drawing 3 expresses with the reference value the value (K-refl) which multiplied by the coefficient. In addition, a coefficient takes the value of $0< K<=1$.
[0028] Then, although it is stopped by supply of ozone gas, (m) and the wafer of the processing interior of a room are taken out by the cassette and (n) ashing processing is ended Whether all the wafers in a cassette were processed at the step (o), and when it judges and there is an unsettled wafer, it returns to a step (b) and operation which processes the following wafer is performed, and it operates [o / (o) / from a step (b) to] until the wafer of a cartridge is lost.
[0029] Moreover, it was judged as the dirt of a cell to which reactant gas (carbon dioxide gas is included) is led if the output M of an A-D converter becomes smaller than the dirt detection set point D by (k) when having repeated the aforementioned step (j), (k), and (l), and the cure which it had when dirt had been accumulated gradually, although it was the system which cannot become dirty comparatively easily is taken by displaying that a cell is checked (p).
[0030]
[Effect of the Invention] By according to this invention, preparing the selector valve which changes reactant gas to the 1st exhaust air path and the 2nd exhaust air path, changing a selector valve to a detector cell side or an exhaust side, and changing the flow of reactant gas into the path to a processing room and an exhaust port arbitrarily The dirt of a detector cell is mitigable by discharging the gas of comparatively a lot of resist components removed from the wafer in early stages of ashing processing from an exhaust port through a jet pipe and an ozonolysis machine, without passing to a detector cell.
[0031] Moreover, it is reference level Refl about an A-D converter output value when after [carrying in] fixed time tl passes a wafer in a processing room in measurement of reactant gas. After carrying out, The A-D converter output value after fixed time t2 progress is reference level Refl. By considering as the terminal point of ****** ashing processing, the time which decreased several% Since the level which judges the terminal point of processing is not fixed, the influence of dirt is mitigable also to change of the signal level by the dirt of the detector cell produced in prolonged use.
[0032] Consequently, since [for example,] carbon-dioxide-gas concentration is compared only only within the between under processing of a wafer even if the cell which forms the passage of gas by aging becomes dirty and it changes the output level of amplifier in the long run, Since a performance top problem will be lost if only the between under processing of a wafer is stabilized and can detect carbon-dioxide-gas concentration even if it changes the output level of amplifier in the long run, the processing terminal point detector of the semiconductor fabrication machines and equipment with which a malfunction cannot happen easily can be offered.

[Translation done.]